(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 822 524 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.02.1998 Bulletin 1998/06

(51) Int Cl.[6]: **G07F 7/10**

(21) Application number: **97304987.7**

(22) Date of filing: **08.07.1997**

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV RO SI

(30) Priority: **03.08.1996 GB 9616386**

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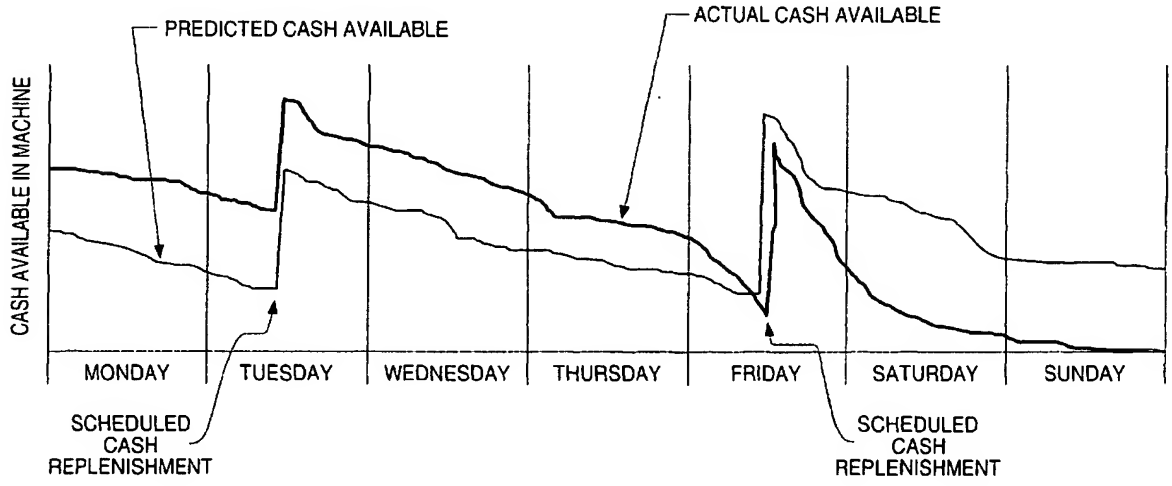
(54) Method of evaluating cash dispensing patterns at a self-service terminal

(57) Cash dispensing patterns at an ATM are evaluated to facilitate maintaining a cash dispenser (18) of the ATM with sufficient cash. The amount of cash dispensed during a particular transaction at the ATM is determined. The time at which the cash was dispensed is also determined. An actual dispense pattern is then determined which is based upon the amount of cash dispensed and the time at which the cash was dispensed. The actual dispense pattern is compared with a predicted dispense pattern stored in a memory (34). Based upon the results of this comparison, a real-time signal is generated which is indicative of when the cash dispenser (18) should be replenished.

FIG. 6



EP 0 822 524 A2

Description

The present invention relates to self-service terminals which dispense cash, and is particularly directed to a method of evaluating patterns of dispensing cash at a self-service terminal to predict future cash replenishment requirements.

A typical self-service terminal which dispenses cash, such as an automated teller machine (ATM), usually operates twenty-four hours per day, seven days per week. Since ATM users can withdraw cash at any time, the ATM needs to be stocked with sufficient cash to allow cash to be dispensed when required. A known method of determining the amount of cash to be stocked at a particular ATM is to use previous cash dispense totals at that ATM. For example, periodic cash dispense totals, such as daily or weekly cash dispense totals, may be used to predict future cash replenishment requirements at a particular ATM and, thus, the amount of cash to be stocked at that ATM.

A disadvantage in using previous cash dispense totals to predict future cash replenishment requirements at a particular ATM is that the actual amount of cash being dispensed at that ATM may exceed the predicted level of cash dispensing. The actual amount may exceed the predicted level because of a special event, such as a sporting event or concert, being held in the vicinity of the ATM. As a result, the ATM may run out of cash before the next scheduled replenishment. If the ATM runs out of cash before the next scheduled replenishment, an emergency cash replenishment of the ATM needs to be made. The costs associated with carrying out an emergency cash replenishment are relatively higher than the costs associated with carrying out a scheduled cash replenishment of the ATM. Accordingly, extra costs are incurred if an emergency cash replenishment of the ATM needs to take place. Moreover, if the ATM runs out of cash before the next scheduled replenishment, users may go to an ATM owned by a competing financial institution, possibly resulting in loss of revenue and business.

It is an object of the present invention to provide a method of evaluating the dispensing of cash at a self-service terminal which enables the terminal to be operated in an efficient manner as regards cash replenishment.

In accordance with one aspect of the present invention, there is provided a method of evaluating a pattern of dispensing cash at a self-service terminal, characterized by the steps of: (a) monitoring a real time pattern characteristic associated with cash dispensed at the self-service terminal; (b) comparing the pattern characteristic of step (a) with preset dispense data; and (c) generating an alert signal independence upon the comparison of step (b).

Preferably, the pattern characteristic of step (a) is the amount of cash dispensed at the self-service terminal in relation to time. The preset dispense data is indicative of what the dispense pattern for the self-service terminal may be for a period in the future. The alert signal in step (c) is indicative of whether or not cash has been dispensed at the self-service terminal as previously predicted.

Preferably, the alert signal is indicative of dispensed cash at the self-service terminal being higher than predicted by at least a predetermined amount, or dispensed cash being lower than predicted by at least a predtermined amount. Cash dispense lower than predicted can be due to a hardware failure in the terminal which restricts dispense capability, e.g. dispenser failure or display failure.

In accordance with another aspect of the present invention, there is provided a method of evaluating cash dispensing patterns at an automated teller machine (ATM) to facilitate maintaining a cash dispenser of the ATM with sufficient cash, characterized by the steps of: (a) determining the amount of cash dispensed during a particular transaction at the ATM; (b) determining the time at which step (a) occurred; (c) determining an actual dispense pattern based upon the determinations of steps (a) and (b); (d) comparing the actual dispense pattern of step (c) with a predicted dispense pattern stored in a memory; and (e) generating a real-time signal indicative of when the cash dispenser should be replenished based upon the results of the comparison of step (d).

One embodiment of the present invention will now be described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a block diagram representation of a banking system including an automated teller machine (ATM) embodying the present invention;

Fig. 2 is a perspective view of the ATM of Fig. 1;

Fig. 3 is a block diagram representation of the ATM of Fig. 2;

Fig. 4 is a flow chart depicting a process carried out by the ATM of Figs. 1-3;

Fig. 5 is a graph illustrating an actual dispense pattern and a predicted dispense pattern over a period of a week at the ATM of Figs. 1-3; and

Fig. 6 is a graph illustrating actual cash available and predicted cash available over a period of a week at the ATM of Figs. 1-3.

The present invention is directed to a method of evaluating cash dispensing patterns at a self-service terminal. The particular construction and use of the self-service terminal may vary. By way of example, a banking system 5 including a self-service terminal 10 is illustrated in Fig. 1. The self-service terminal 10 is in the form of an automated teller machine (ATM).

The ATM 10 communicates via a line 90 through a standard communication network 92 which, in turn, communicates via a line 94 with a remote computer 96. The remote computer 96 is typically a large scale computer located at a central site of a financial institution. As is known, the remote computer 96 monitors various parameters associated with operation of the ATM 10.

Referring to Figs. 2 and 3, the ATM 10 includes a user interface 12 having a front panel. The user interface 12 includes a card reader 14, a key pad 16, a cash dispenser 18, a CRT display 20, and a receipt printer 22. The card reader 14 has a card slot in the front panel of the user interface 12 through which a customer 24 can insert a user's identifying card 26 at the commencement of a transaction to be conducted by the customer 24. The cash dispenser 18 has a cash slot through which cash currency notes stored inside the ATM 10 can be delivered to the customer 24 during the transaction. The receipt printer 22 has a receipt slot through which a receipt of the transaction is delivered to the customer 24 at termination of the transaction.

When the customer 24 inserts the user's identifying card 26 into the card slot of the card reader 14, the card reader reads data contained on the card. The customer 24 is then prompted on the CRT display 20 to enter a personal identification number (PIN) via the key pad 16. After the correct PIN is entered, menus are displayed on the display 20 to enable the customer 24 to carry out the desired transaction. After the transaction is completed, the receipt printer 22 prints a receipt of the transaction and delivers the receipt through the slot of the receipt printer 22 to the customer 24.

The ATM 10 also includes a controller unit 30 which communicates with components of user interface 12. The controller unit 30 includes a processor unit 32, and a memory unit 34 connected via bus line 36 to the processor unit 32. The processor unit 32 receives input signals on lines 42, 44 from the card reader 14 and the key pad 16, respectively, and provides output signals on lines 46, 48, 50 to the cash dispenser 18, the CRT display 20, and the receipt printer 22, respectively, to control the amount of cash dispensed by the cash dispenser 18, the information displayed on the CRT display 20, and the information printed by the receipt printer 22. The processor unit 32 also communicates via the line 90 through the communication network 92 and the line 94 with the remote computer 96, as previously described.

Referring to Fig. 4, a flow chart depicts a process carried out at the ATM 10 in accordance with the present invention. In step 100, the processor unit 32 makes a real-time determination as to whether the cash dispenser 18 has been instructed to dispense any cash. If the determination in step 100 is negative, the process ends. If the determination in step 100 is affirmative, the process proceeds to step 102 in which a determination is made as to the amount of cash dispensed by the cash dispenser 18. A determination is then made in step 104 as to the actual time of the day that cash was dispensed by the cash dispenser 18. Also, the total actual amount of cash dispensed since the last replenishment is determined in step 106. The actual amount of cash dispensed, the actual time the dispensing of cash occurred, and the total amount of cash dispensed since the last replenishment are stored in the memory unit 34. The information relating to the actual amount of cash dispensed includes the number of dispensed bills and the denomination of the dispensed bills. The information relating to the actual time is obtained from a system clock of the ATM 10.

The process then proceeds to step 108 in which the processor unit 32 determines an actual dispense pattern of cash dispensed by the cash dispenser 18 since the last replenishment. An example of an actual dispense pattern over a week period is illustrated in Fig. 5. The actual dispense pattern is compared with a predicted dispense pattern stored in a historical file in the memory unit 34, as shown in step 110. An example of a predicted dispense pattern is also illustrated in Fig. 5.

The predicted dispense pattern is the result of the historical cash dispense information associated with the particular ATM 10. The predicted dispense pattern is created using actual cash dispense information (e.g., the number of dispensed bills and the denomination of the dispensed bills) and actual times of previous transactions. The predicted dispense pattern shown in Fig. 5 is divided into discrete periods (i.e., days) and shows the expected cash amounts to be dispensed in each period. Although the predicted dispense pattern of Fig. 5 is divided into days, it is contemplated that the predicted dispense pattern may be divided into hours or weeks, for example. After the comparison carried out in step 110, the process proceeds to step 112 in which the historical file in the memory unit 34 is updated with the new actual dispense pattern data.

A determination is made in step 114 as to whether the actual dispense pattern obtained in step 108 corresponds to the predicted dispense pattern (PDP) stored in the memory unit 34. If the determination in step 114 is affirmative, the process ends. If the determination in step 114 is negative, the process then proceeds to step 116 in which a determination is made as to whether the total actual amount of cash which has been dispensed by the cash dispenser 18 is higher than a predicted amount by a first predetermined value. The predicted amount and the first predetermined value are stored in the memory unit 34. If the determination in step 116 is affirmative, the process proceeds to step 122 in which a flag is raised indicating that more cash needs to loaded in the cash dispenser 18 of the ATM 10 before the next scheduled replenishment. If the determination in step 116 is negative, the process proceeds to step 117. A determination is made in step 117 as to whether the total actual amount of cash which has been dispensed by the cash dispenser 18 is lower than the predicted amount by a second predetermined value. The predicted amount and the second predetermined value are stored in the memory unit 34. If the determination in step 117 is affirmative, the process proceeds to step 119 in which a flag is raised indicating that sufficient cash is available to be dispensed and that the

next scheduled replenishment may be postponed. If the determination in step 117 is negative, the process proceeds to step 118.

In step 118, a determination is made as to whether a hardware problem related to the cash dispenser 18 exists. If the determination in step 118 is affirmative, the process proceeds to step 124 in which a flag is raised indicating that a hardware problem related to the cash dispenser 18 exists within the ATM 10. This is a possible cause of a low cash dispense determined in step 117. If the determination in step 118 is negative, the process proceeds directly to step 120 in which any raised flag is sent to the remote computer 96 for further processing.

When the remote computer 96 receives a raised flag from the controller unit 30 of the ATM 10, the computer provides an indication to an operator at the computer that some action is needed. Thus, the action needed may be to fix an existing hardware problem at the ATM, or to avoid a potential problem (i.e., the ATM 10 running out of cash before the next scheduled replenishment) which may occur at the ATM, or to postpone the next scheduled replenishment. The operator then takes any necessary action. The computer 96 then recalculates a new predicted dispense pattern which is downloaded into the memory unit 34 within the ATM 10 for future use. The predicted dispense pattern stored in the memory unit 34 is thereby updated.

Preferably, the cash dispensing characteristics in each period will have a relationship with the cash dispensing characteristics in another period. An example of such relationships is illustrated below:

PERIOD	RELATIONSHIP
T-3	
T-2	= (T-3)
T-1	= (T-2)-10%
T	= (T-1)+22%
T+1	= (T-3)+40%
T+2	= (T-1)+50%
T+3	= (T+2)-33%

If the actual dispense amounts in previous periods are the following:

PERIOD	NUMBER OF BILLS DISPENSED
T-3	500
T-2	700
T-1	750
T	660

then the predicted dispense amounts for future periods are as follows:

PERIOD	PREDICTED NUMBER OF BILLS TO BE DISPENSED	RELATIONSHIP
T+1	700	= (T-3)+40%
T+2	1125	= (T-1)+50%
T+3	750	= (T+2)-33%

The example above is simplified since only the total cash amount dispensed is considered. It is expected that each denomination of bills will be considered in the same manner.

A number of advantages result by evaluating cash dispensing patterns at the ATM 10 in accordance with the present invention. One advantage is that the chance of the cash dispenser 18 of the ATM 10 running out of cash is minimized. The chance is minimized because of the operator being informed in real-time of the cash condition of the cash dispenser 18 of the ATM 10. To better describe this advantage, a graph depicting the cash available at the ATM 10 is shown in Fig. 6. As shown in Fig. 6, cash replenishments are scheduled to occur on Tuesday and on Friday. By evaluating cash dispensing patterns in accordance with the present invention as described hereinabove, a decision may be made to increase the amount of the cash replenishment scheduled on Friday to avoid an out of cash position during the weekend. Also, a decision may be made to carry out a further cash replenishment on Saturday to avoid an out of cash position on Sunday. Moreover, a decision may be made that there is sufficient cash in the ATM 10 on Tuesday to last until the next scheduled cash replenishment to take place on Friday. Accordingly, it may be decided that the scheduled cash replenishment on Tuesday is not needed.

Another advantage is that costs associated with emergency replenishments are eliminated or at least minimized. Still another advantage is that possible loss of revenue from potential transactions not carried out at the ATM 10 is avoided.

Claims

1. A method of evaluating a pattern of dispensing cash at a self-service terminal, characterized by the steps of: (a) monitoring a real time pattern characteristic associated with cash dispensed at the self-service terminal; (b) comparing the pattern characteristic of step (a) with preset dispense data; and (c) generating an alert signal independence upon the comparison of step (b).

2. A method according to claim 1, characterized in that the pattern characteristic of step (a) is the amount of cash dispensed at the self-service terminal in relation to time.

3. A method according to claim 2, characterized in that the preset dispense data is indicative of what the dispense pattern for the self-service terminal is predicted to be for a period in the future.

4. A method according to claim 3, characterized in that the alert signal is indicative of dispensed cash at the self-service terminal being higher than predicted by at least a predetermined amount.

5. A method according to claims 3, characterized in that the alert signal is indicative of dispensed cash at the self-service terminal being lower than predicted by at least a predetermined amount.

6. A method according to anyone of the preceding claims, characterized by the step of (d) generating a status signal which is indicative of a possible hardware fault restricting the dispensing of cash.

7. A method of evaluating cash dispensing patterns at an automated teller machine (ATM) to facilitate maintaining a cash dispenser (18) of the ATM with sufficient cash, characterized by the steps of (a) determining the amount of cash dispensed during a particular transaction at the ATM; (b) determining the time at which step (a) occurred; (c) determining an actual dispense pattern based upon the determinations of steps (a) and (b); (d) comparing the actual dispense pattern of step (c) with a predicted dispense pattern stored in a memory (34); and (e) generating a real-time signal indicative of when the cash dispenser (18) should be replenished based upon the results of the comparison of step (d).

8. A method according to claim 7, characterized by the step of: (f) determining if a hardware fault is present restricting the dispensing of cash and providing a signal indicative thereof.

9. A method according to either claim 7 or claim 8, characterized in that step (d) involves determining if the actual dispense pattern of step (c) is either higher or lower than a predicted amount associated with the predicted dispense pattern.

FIG. 1

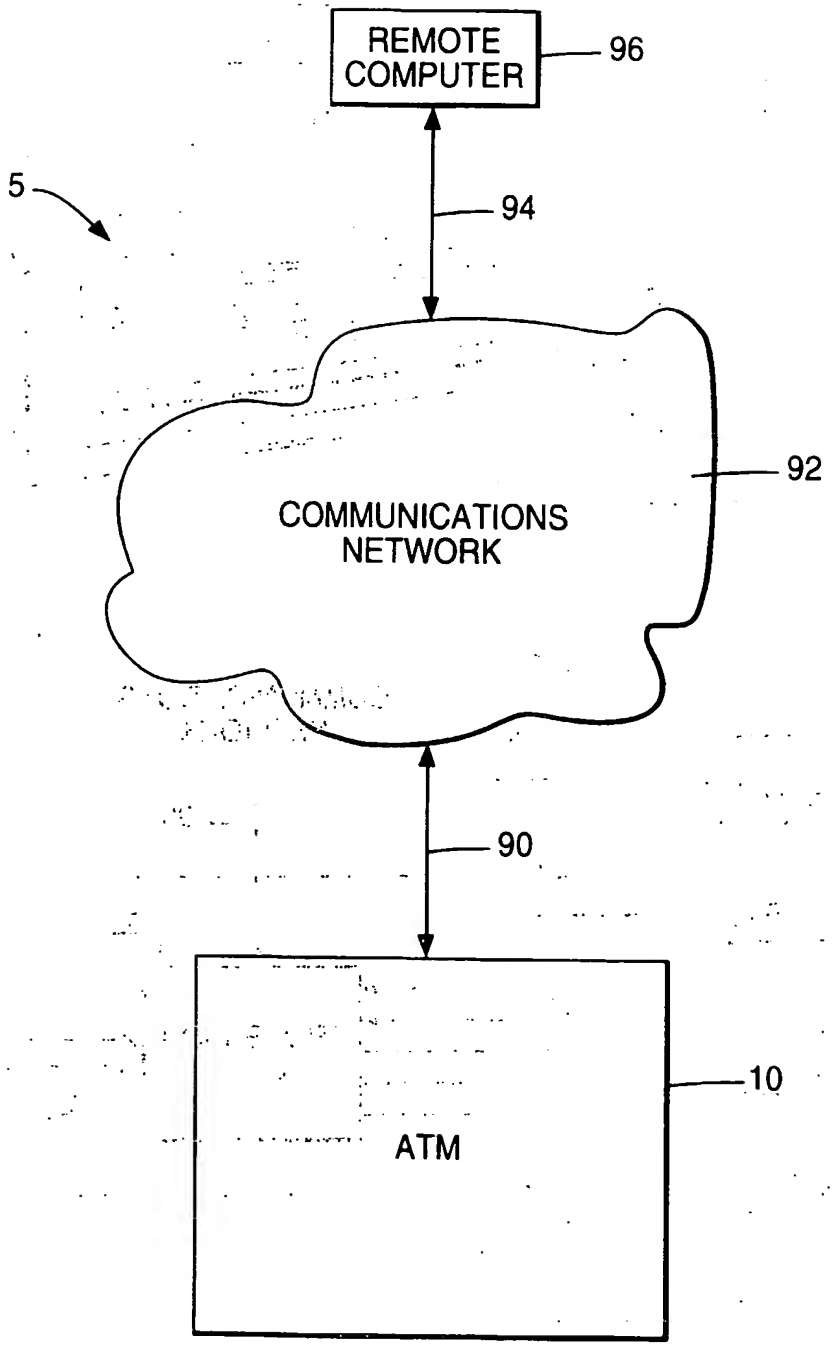


FIG. 2

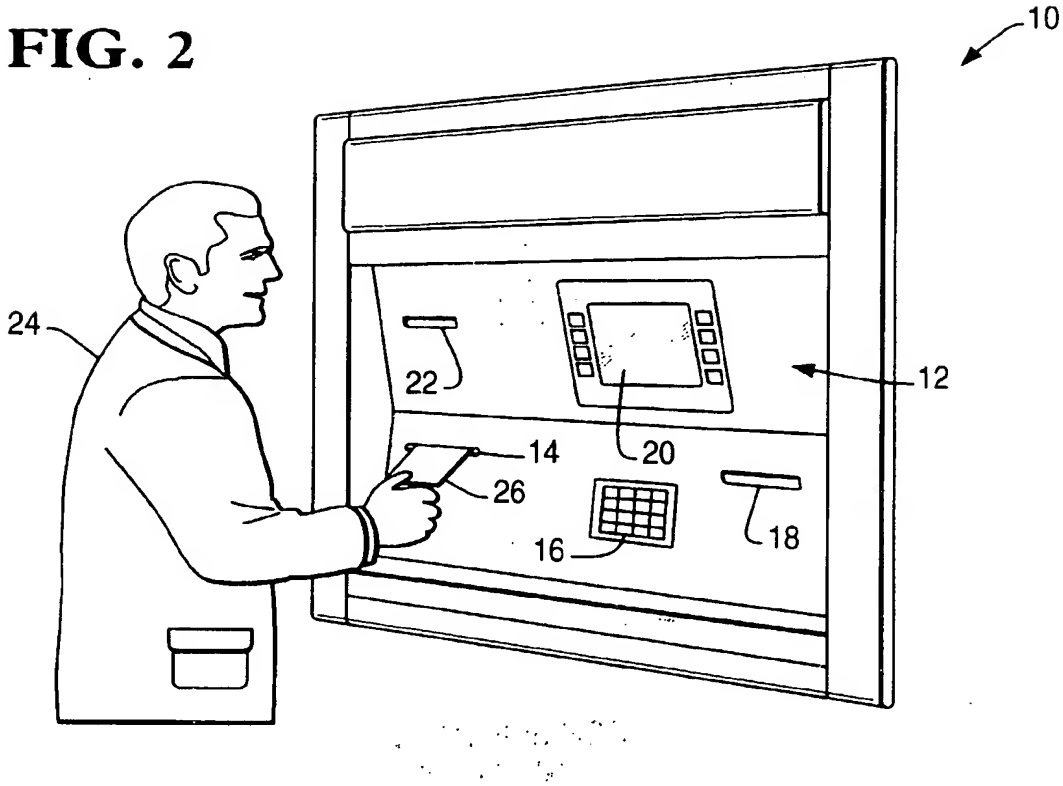

10
24
22
12
14
20
26
16
18

FIG. 3

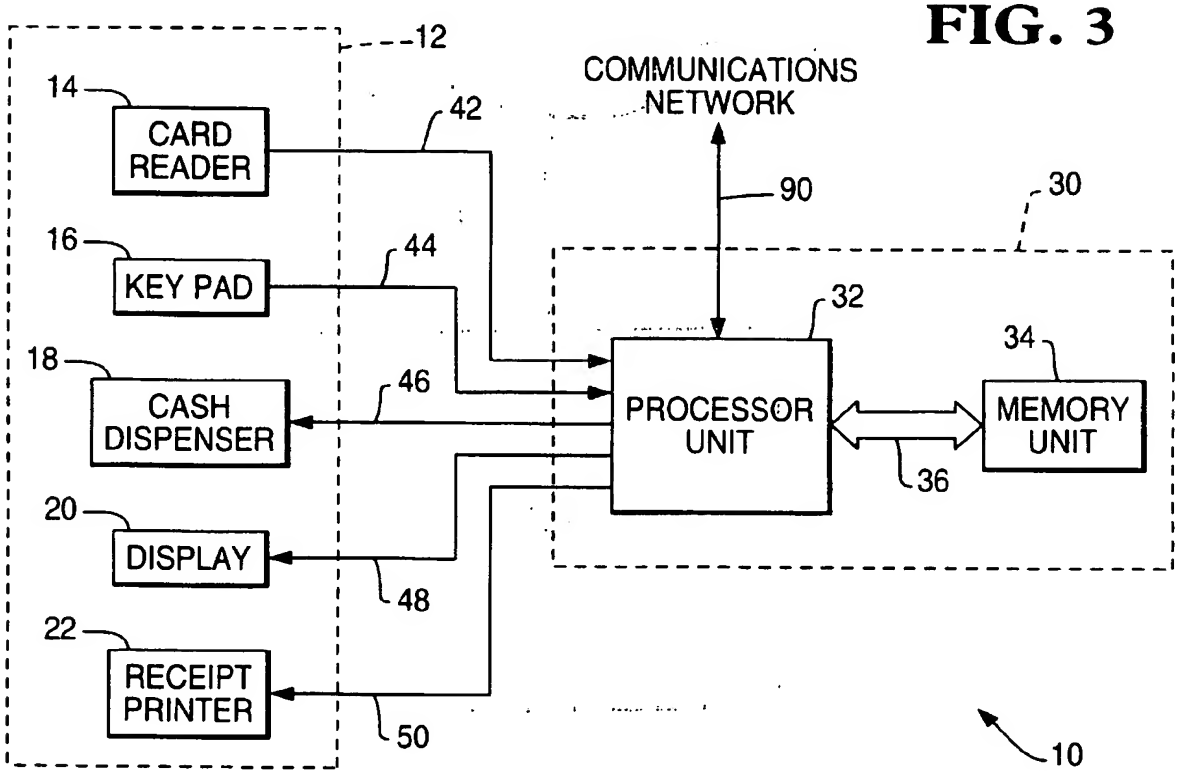
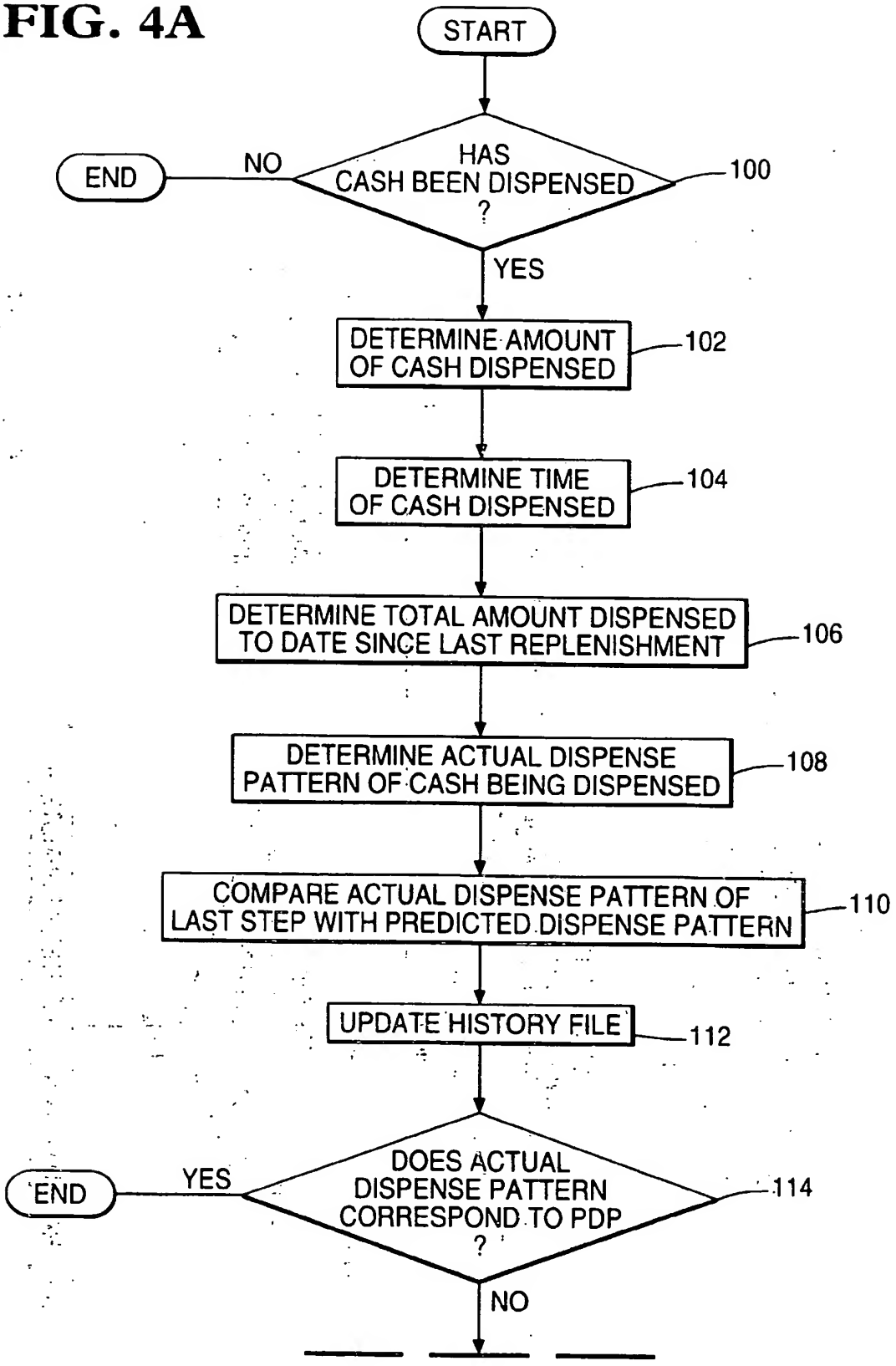

12
14
CARD READER
42
COMMUNICATIONS NETWORK
90
30
16
KEY PAD
44
32
34
18
CASH DISPENSER
46
PROCESSOR UNIT
MEMORY UNIT
36
20
DISPLAY
48
22
RECEIPT PRINTER
50
10

FIG. 4A


START
HAS CASH BEEN DISPENSED ?
100
NO
END
YES
DETERMINE AMOUNT OF CASH DISPENSED
102
DETERMINE TIME OF CASH DISPENSED
104
DETERMINE TOTAL AMOUNT DISPENSED TO DATE SINCE LAST REPLENISHMENT
106
DETERMINE ACTUAL DISPENSE PATTERN OF CASH BEING DISPENSED
108
COMPARE ACTUAL DISPENSE PATTERN OF LAST STEP WITH PREDICTED DISPENSE PATTERN
110
UPDATE HISTORY FILE
112
DOES ACTUAL DISPENSE PATTERN CORRESPOND TO PDP ?
114
YES
END
NO

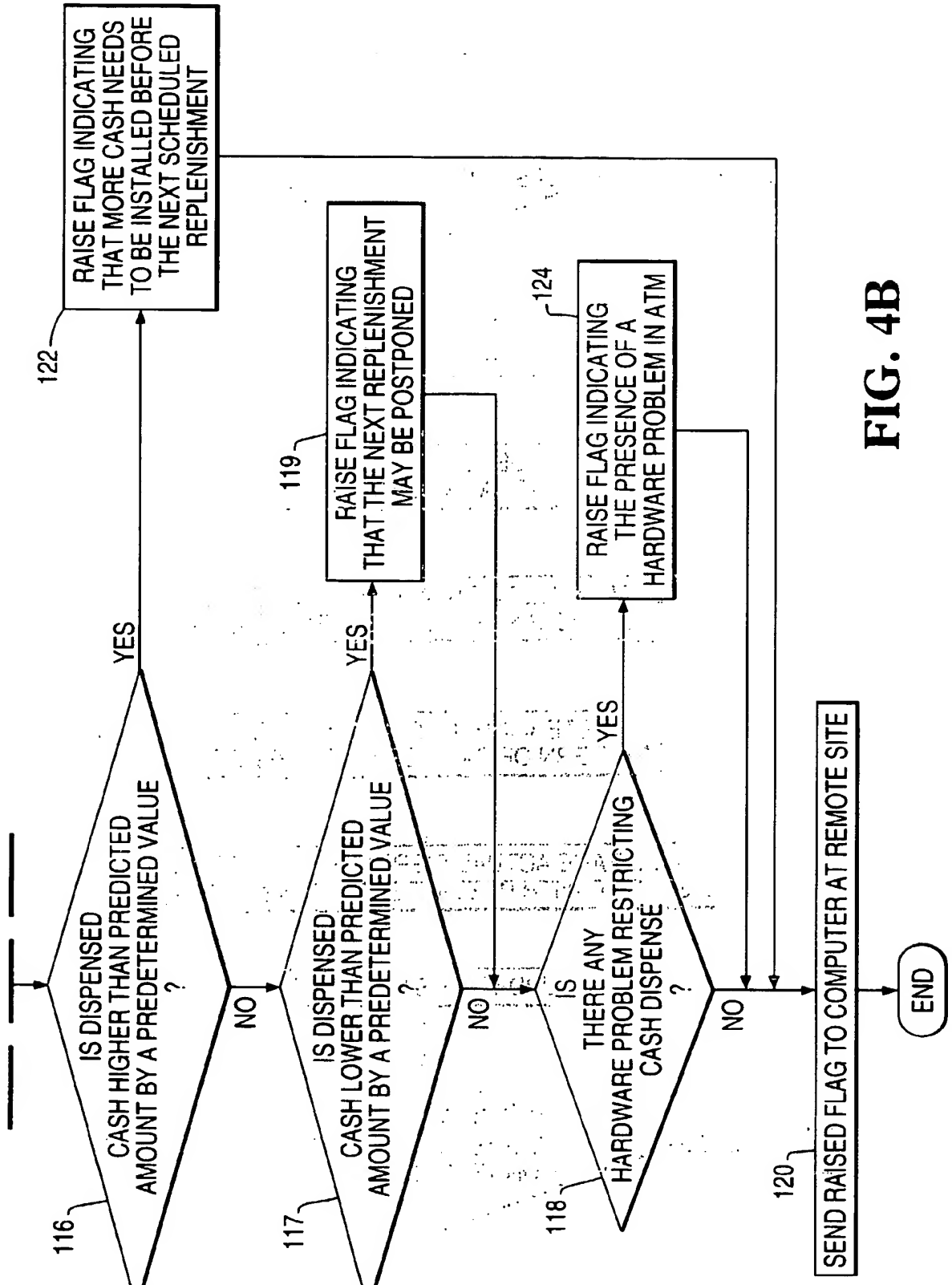

IS DISPENSED CASH HIGHER THAN PREDICTED AMOUNT BY A PREDETERMINED VALUE ?
116
YES
NO
RAISE FLAG INDICATING THAT MORE CASH NEEDS TO BE INSTALLED BEFORE THE NEXT SCHEDULED REPLENISHMENT
122
IS DISPENSED CASH LOWER THAN PREDICTED AMOUNT BY A PREDETERMINED VALUE ?
117
YES
NO
RAISE FLAG INDICATING THAT THE NEXT REPLENISHMENT MAY BE POSTPONED
119
IS THERE ANY HARDWARE PROBLEM RESTRICTING CASH DISPENSE ?
118
YES
NO
RAISE FLAG INDICATING THE PRESENCE OF A HARDWARE PROBLEM IN ATM
124
SEND RAISED FLAG TO COMPUTER AT REMOTE SITE
120
END

FIG. 4B

FIG. 5

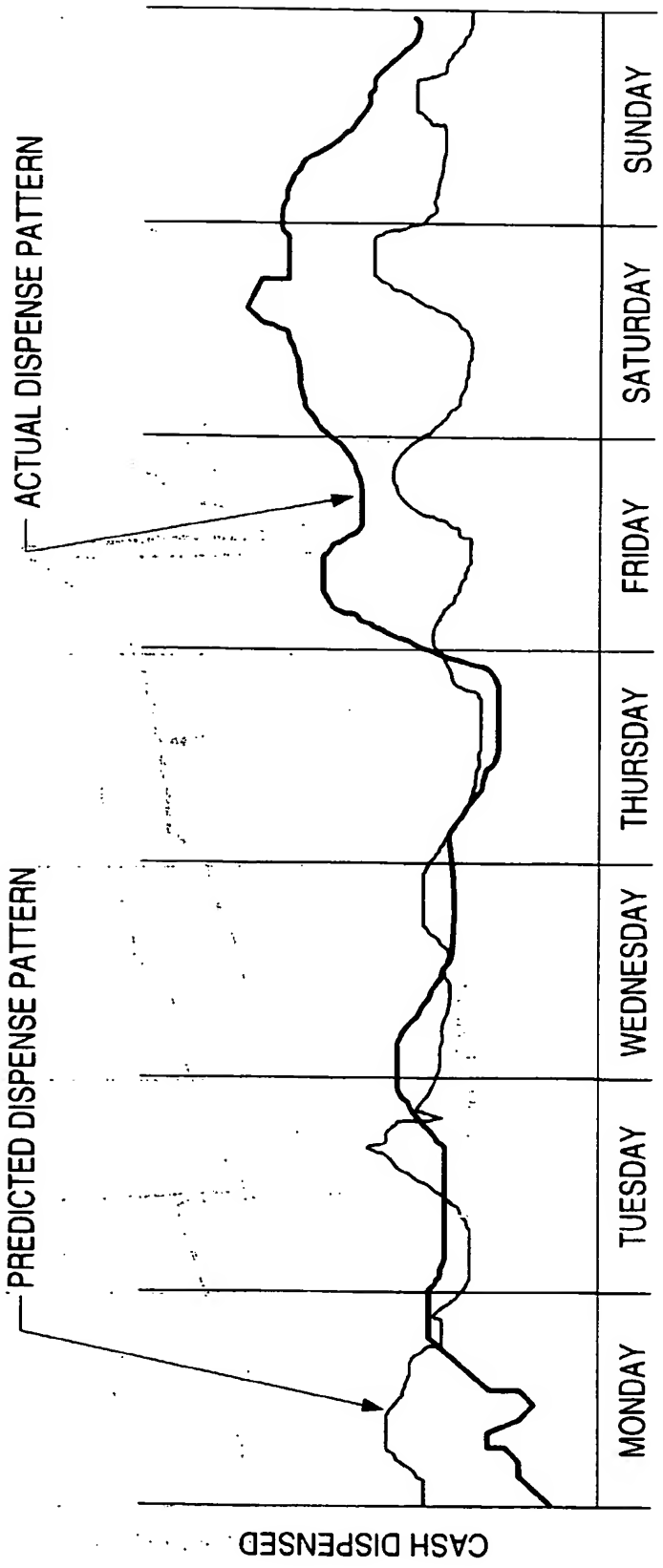
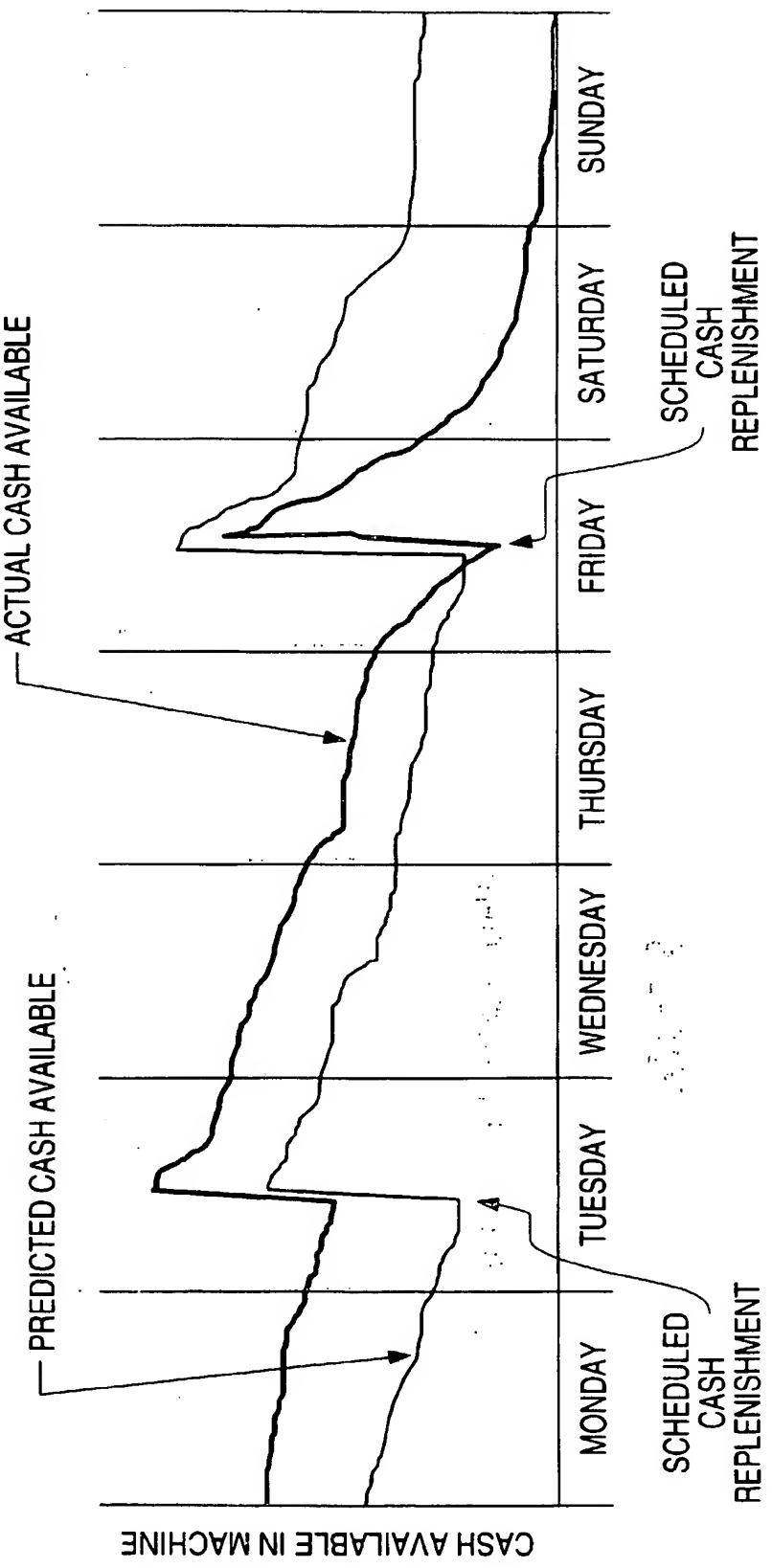

CASH DISPENSED
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
SUNDAY
PREDICTED DISPENSE PATTERN
ACTUAL DISPENSE PATTERN

FIG. 6


CASH AVAILABLE IN MACHINE
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
SUNDAY
PREDICTED CASH AVAILABLE
ACTUAL CASH AVAILABLE
SCHEDULED CASH REPLENISHMENT
SCHEDULED CASH REPLENISHMENT

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(74) Representative: **Irish, Vivien Elizabeth**
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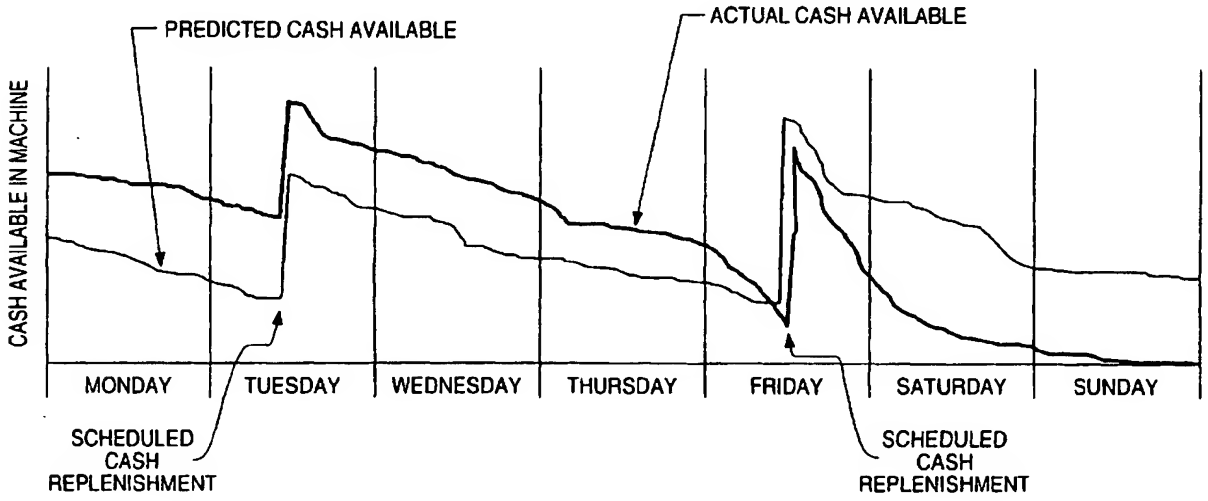
FIG. 6



EP 0 822 524 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 30 4987

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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Y A	EP 0 712 099 A (AT & T GLOBAL INF SOLUTION) 15 May 1996 (1996-05-15) * column 3, line 3 - line 26 * * figure 6 *	6,8 1-5,7,9	
A	US 5 051 900 A (ITO MICHIRO ET AL) 24 September 1991 (1991-09-24) * column 5, line 4 - column 6, line 4 * * figures 3A,6 *	1-5,7,9	
P,X	EP 0 753 524 A (FUJITSU LTD) 15 January 1997 (1997-01-15) * abstract * * page 4, line 57 - page 5, line 32 *	1-5,7,9	TECHNICAL FIELDS SEARCHED (Int.Cl.6) G07F G07D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 September 1999	Van Dop, E

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 97 30 4987

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on . . The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

23-09-1999

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82